

# SCAG PECAS Land Use Model Development

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SCAG Modeling Task Force Meeting  
1/26/2011

## Contents

- Project Status (end of 2010)
- Scenario Test
  - Baseline
  - Gas price, VMT Fee
  - TOD
- Short & Mid Term Action Items



## Status

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- The Land Use Model is running for multi-year
  - With SCAG regional data
  - With sensitivity parameters from the statewide model
  - With a version of Space Development module that limits demolition
- Model Outputs
  - Floor space for the year 2035
  - Rent increase
  - Transit oriented development capacity
  - Households and Jobs

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## Status

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- By Task
  - Design Knowledge Transfer Framework
  - Design SCAG PECAS Model
  - Statewide PECAS Model Transfer
  - Knowledge Transfer
    - Based on the Statewide Mode and Data
    - Staff follows the Model Development Process
    - Workshops and weekly conference
    - Model runs by staff, review with consultant
  - Calibration and Scenario Test ... under process

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## Status

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- Yr 2009
  - 10 Workshops over 28 days at SCAG or UCD
  - Covered Topics are
    - Model structure, Source Code, Data Structure
    - Synthesizing Missing Information
    - Model Runs and Scenario Development
    - Calibration Strategy and Method
- Yr 2010
  - Weekly Conference Calls
  - Major thrust in Data Development
  - Currently, Scenario Test and Calibration stage

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## Status

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### By PECAS Modeling Process

		Not started	Statewide Model	Initiated	Completed
Establish Space Rents and Rent Modifier Equations	Develop Commodity Production Zonal Level Targets				
Establish Space Transition Cost System	Develop Commodity Consumption Zonal Level Targets				
Establish Space Maintenance Cost Equations	Develop Commodity Spatial Flow Targets				
Establish Base Year Parcel Database	Develop Imports and Exports Targets by External Zone				
Establish Base Year Space Quantities by Zone	Establish Imports and Exports Equation Parameters				
Establish All-Year Parcel Inputs for Calibration Period	Develop Skim Matrices From Transport Model				
Establish Pseudo-Parcel Settings and Space Transition Constants	Establish X-Vector Attribute Values				
Establish Transport Utility Equations	Establish Buying and Selling Utility Equation Parameters				
Establish Floor Space Short-Run Supply Curves	Establish Size Terms for Import and Exports Commodities				
Identify Household Technology Option Points	Establish Technology Allocation Utility Equation Parameters				
Identify Industrial Technology Option Points	Establish Location Allocation Utility Sensitivity Parameters				
Identify Accounts Categories Technology Option Points	Establish Location Allocation Utility Equation Zone Constants				
Develop Labor Production Zonal Level Targets	Develop Transport Model Inputs From PECAS Outputs				
Develop Labor Consumption Zonal Level Targets	Conduct Semi-Automated Stage 3 Calibration				
Develop Labor Spatial Flow Targets					

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## Test Scenarios

- **Baseline**
  - Compare model estimated HH/Job allocation by county to forecast
- **Scenarios**
  - \$3.00/gallon @ 2010 to \$4.72/gallon @ 2020
  - \$0.02/mile VMT Fee
  - Transit Oriented Development



## From the Scenario Tests...

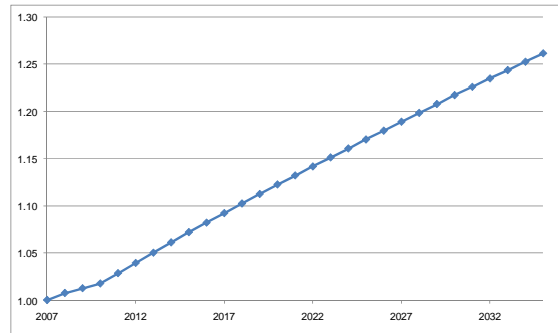
- **Compares to official forecast (Aug 2010 version)**
  - Calibrated with separate space supply (transition) for each county to prevent even growth distribution
  - No transition to 'Vacant' is allowed
- **Model shows significant travel impedance sensitivity to VMT, yet limited sensitivity to household and job reallocation**
- **Limited sensitivity of development capacity to household and job reallocation**
- **Little variation in wage and commodity price spatially as well temporally**
  - imports and exports are controlling the markets



## Baseline

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- Region total control input to model
  - Trend + Local Input (2010 August version)
  - Ratio to 2007 total
- HH



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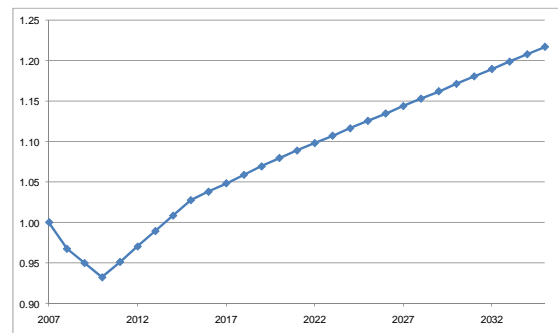
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## Baseline

2/7

- Region total control input to model
  - Trend + Local Input (2010 August version)
  - Ratio to 2007 total
- Job



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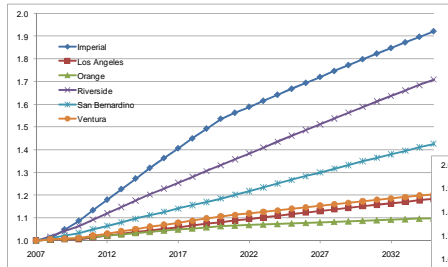
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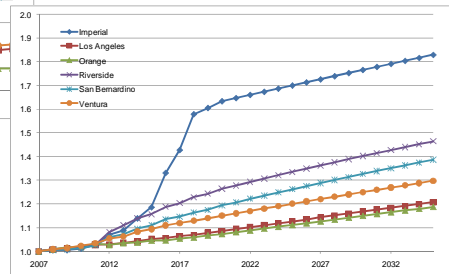
## Baseline

3/7

### Official HH Forecast



### Model Estimate



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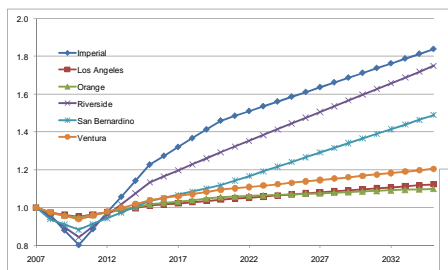
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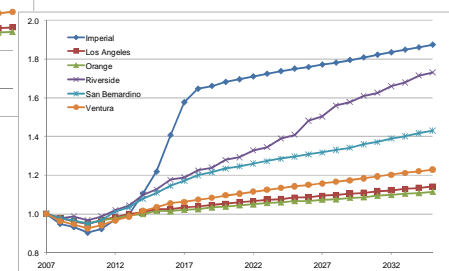
## Baseline

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### Official Job Forecast



### Model Estimate



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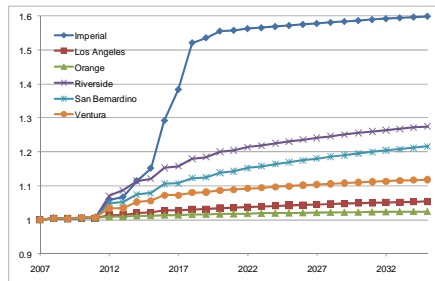


## Baseline

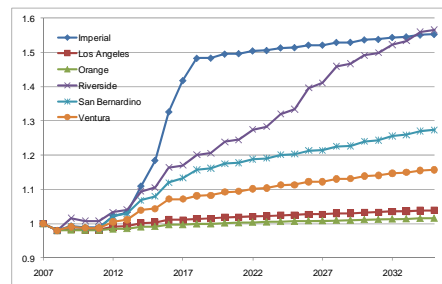
5/7

### Floor space (relative to 2007)

Residential



non-Residential



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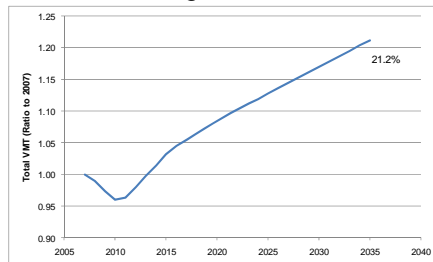


## Baseline

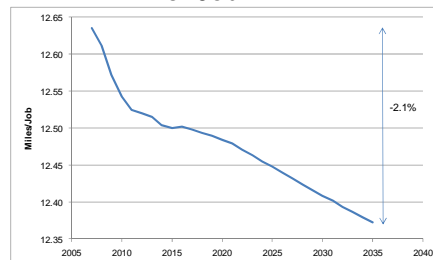
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### Labor Flow Distances (proxy to working trip VMT)

Region Total



Per Job



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## Baseline

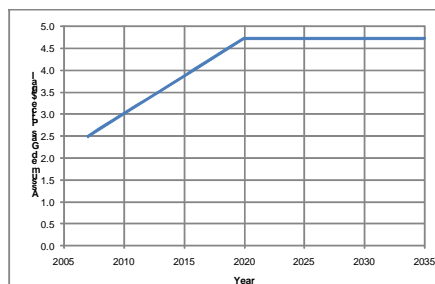
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- Model predicts the same large growth in Imperial, Riverside and San Bernardino as the official forecasts.
- The model predicts more growth in Orange County than the official forecast.

## Scenario: \$4.72/gallon

1/6

- Scenario Implementation
  - \$3.00/gal @ 2010 to \$4.72/gallon @ 2020, then stay same after
  - Assume same MPG, increase to \$4.72/gal is equivalent to 13% increase of driving cost increase.
  - Uniform increase rate between 2007 and 2020, 1% in each year

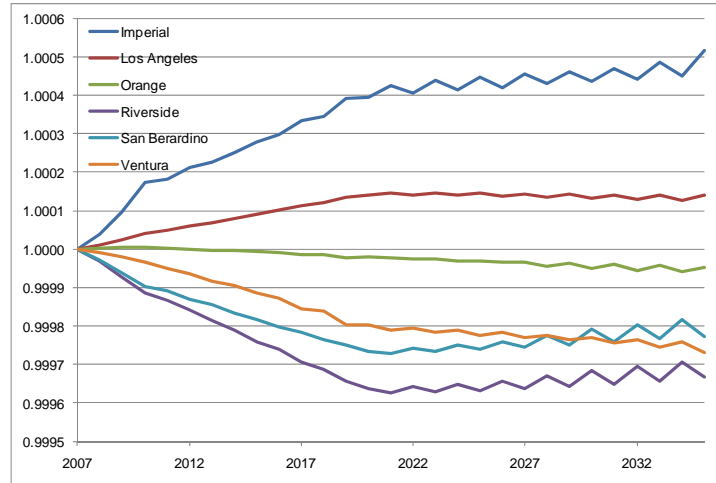




## Scenario: \$4.72/gallon

2/6

### ■ Household Allocation – ratio to baseline



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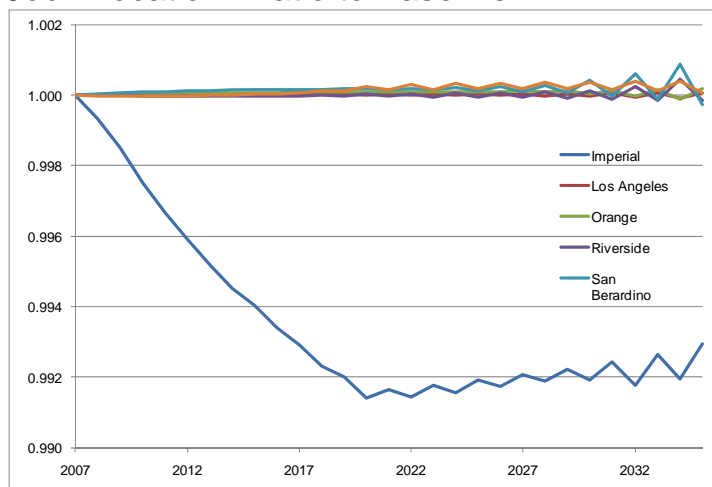
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## Scenario: \$4.72/gallon

3/6

### ■ Job Allocation – ratio to Baseline



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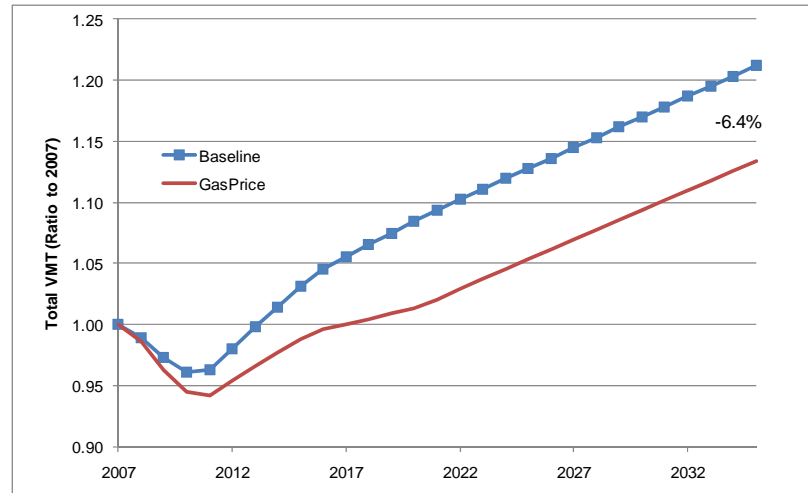
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## Scenario: \$4.72/gallon

4/6

### ■ Total Labor Flow Distances



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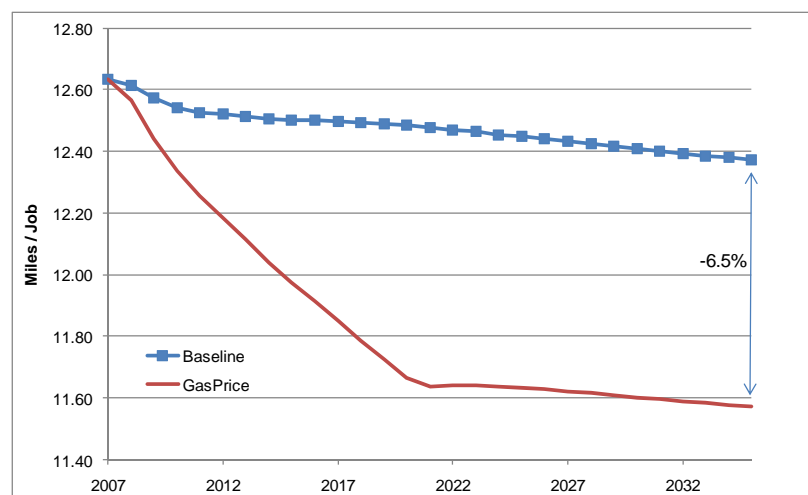
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## Scenario: \$4.72/gallon

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### ■ Labor Flow Distance / Job



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## Scenario: \$4.72/gallon

6/6

- Small shift of households and job between Counties
- Working trip distance directly related to the increase travel cost.
- Intra-county rearrangement of workplaces and residences is important.



## Scenario: VMT Fee

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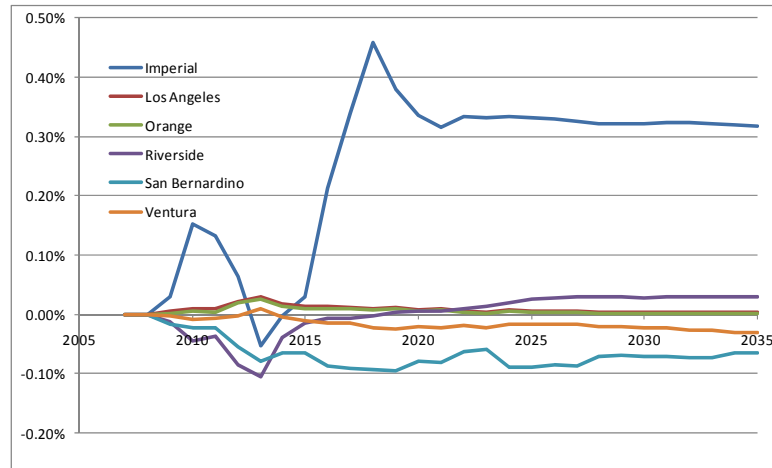
- Scenario Implementation
  - \$0.453 /mile driving cost (2009, AAA)
  - \$0.02 /mile addition equivalents to 4.42% increase in driving cost
  - Increase travel-distance cost factor accordingly



## Scenario: VMT Fee

2/8

### Household by County (Difference from Baseline, %)



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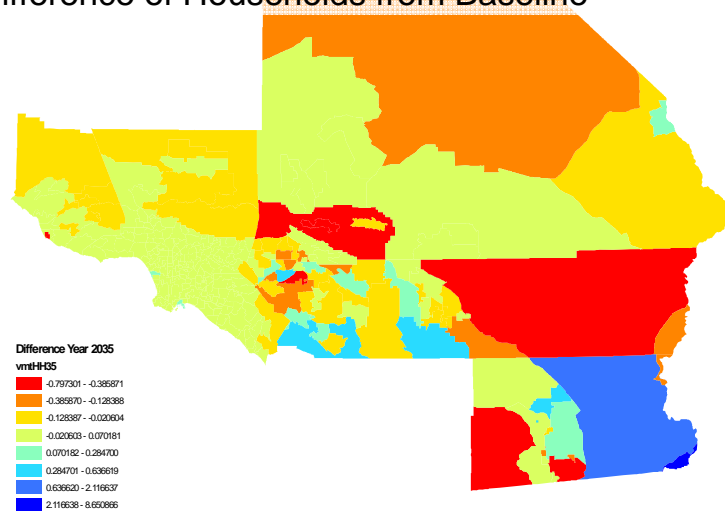
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## Scenario: VMT Fee

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### Difference of Households from Baseline



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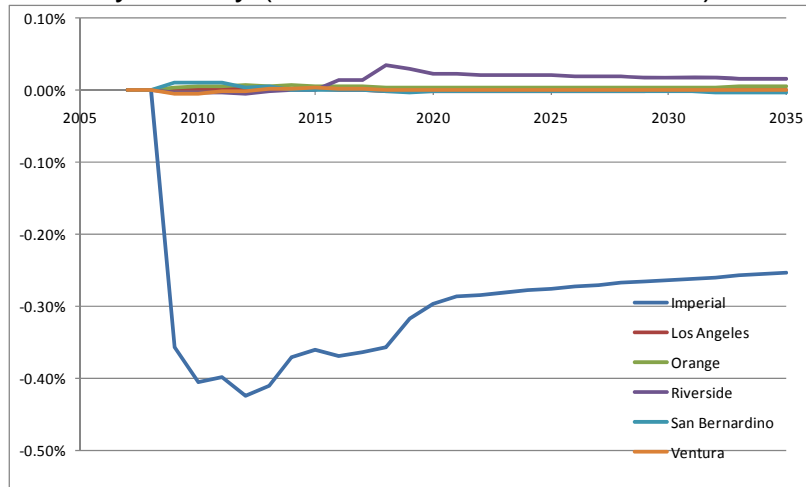
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## Scenario: VMT Fee

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### Job by County (Difference from Baseline, %)



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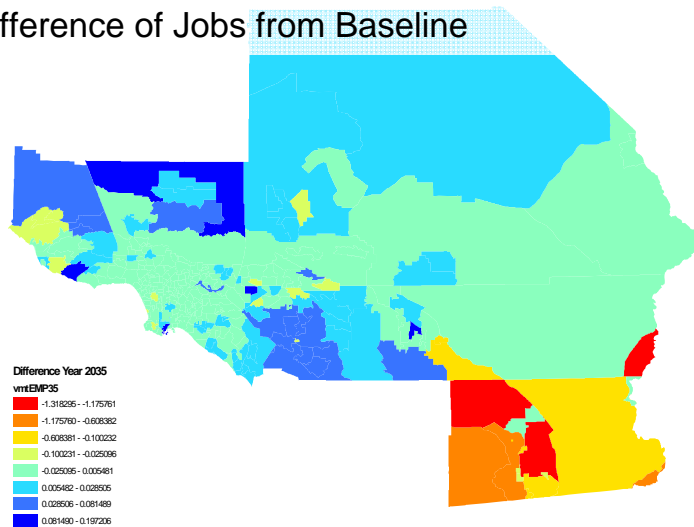
25



## Scenario: VMT Fee

5/8

### Difference of Jobs from Baseline



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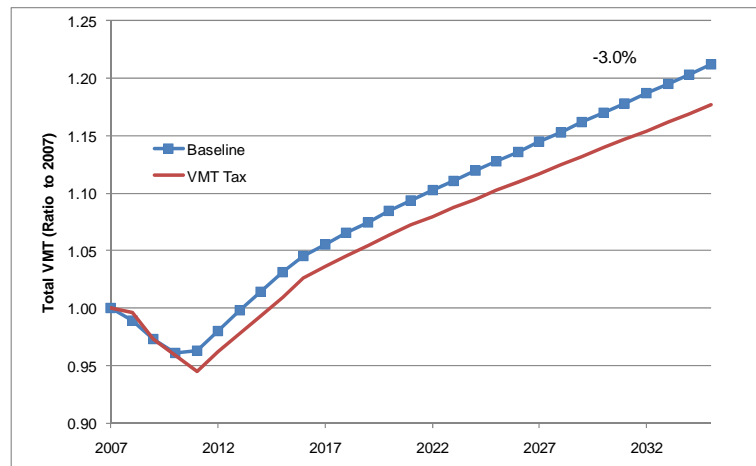
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## Scenario: VMT Fee

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### ■ Total Labor Flow – ratio to baseline



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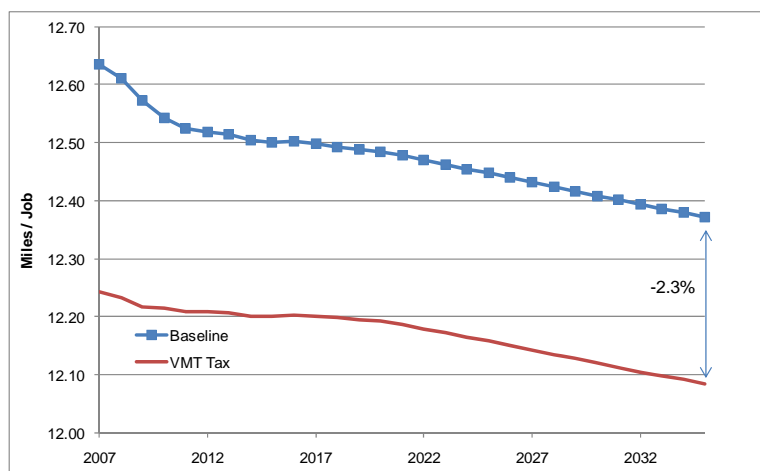
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## Scenario: VMT Fee

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### ■ Labor Flow / Jobs



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## Scenario: VMT Fee

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- Model shows similar allocation pattern to high-gas price scenario
- Imperial county losses jobs, while other counties gains.



## Scenario: TOD

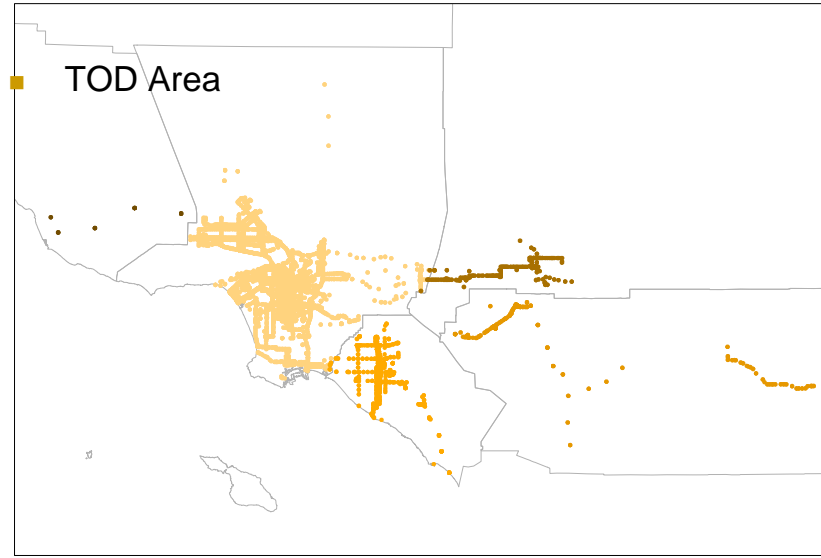
1/13

- TOD1
  - 0.5-mile from the major transit stops on the high quality transit corridor
    - Identify parcels designated as residential and commercial in the general plan
    - Increase 50% of allowable Floor-Area-Ratio from general plan for parcels **currently zoned for multi-family**.
    - Increase 50% of current Floor-Area-Ratio as allowable density for parcels **currently zoned for commercial**.
- TOD2
  - Allow 20 times density in LA county in 0.5 mile.  
No change in other counties



## Scenario: TOD

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## Scenario: TOD

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County	Total Land (10 <sup>6</sup> SQFT) (A)	Parcel Land * (10 <sup>6</sup> SQFT) (B)	HOTC Land Area (0.5 mile radius) (10 <sup>6</sup> SQFT) (C)	Ratio	
				(C) / (A)	(C) / (B)
IMP	124,921.14	782.11	-	-	-
LA	110,198.31	24,323.80	14,189.04	12.88%	58.33%
ORA	22,260.39	9,125.39	2,815.65	12.65%	30.86%
RIV	203,497.98	5,588.20	1,378.51	0.68%	24.67%
SBN	560,257.01	5,057.47	1,608.61	0.29%	31.81%
VEN	51,116.74	2,601.89	109.50	0.21%	4.21%

\*) Mountain/desert area excluded (except already developed parcels)

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## Scenario: TOD

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### ■ Development Capacity

Type-County	Parcel Land 10 <sup>6</sup> SQFT (A)	Floor 10 <sup>6</sup> SQFT (B)	FAR % (B)/(A)	Capacity 10 <sup>6</sup> SQFT (C)	FAR to Capacity (B)/(C)	Scenario TOD1		Scenario TOD2	
						Capacity 10 <sup>6</sup> SQFT (D)	Increment % (D)/(C)-1	Capacity 10 <sup>6</sup> SQFT (E)	Increment % (E)/(C)-1
RES – IMP	266.8	65.3	24.5	133.4	49.0	133.4	0.00	133.4	0.00
RES – LA	9,793.1	4,339.4	44.3	5,076.0	85.5	5,376.8	5.93	11,092.0	118.52
RES – ORA	3,451.5	1,441.3	41.8	1,703.9	84.6	1,744.2	2.36	1,703.9	0.00
RES – RIV	2,602.7	917.3	35.2	1,354.3	67.7	1,375.1	1.54	1,354.3	0.00
RES – SBN	2,441.5	831.3	34.0	1,268.0	65.6	1,287.0	1.50	1,268.0	0.00
RES – VEN	1,065.2	384.4	36.1	518.1	74.2	519.0	0.18	518.1	0.00
NonR – IMP	515.3	43.2	8.4	249.2	17.3	249.2	0.00	249.2	0.00
NonR – LA	14,530.7	2,828.3	19.5	5,676.6	49.8	6,853.7	20.74	29,217.7	414.70
NonR – ORA	5,673.9	1,041.8	18.4	2,249.6	46.3	2,500.4	11.15	2,249.6	0.00
NonR – RIV	2,985.5	421.9	14.1	1,186.9	35.5	1,279.2	7.78	1,186.9	0.00
NonR – SBN	2,616.0	414.5	15.8	984.8	42.1	1,069.5	8.60	984.8	0.00
NonR – VEN	1,536.7	216.6	14.1	587.8	36.9	592.2	0.74	587.8	0.00

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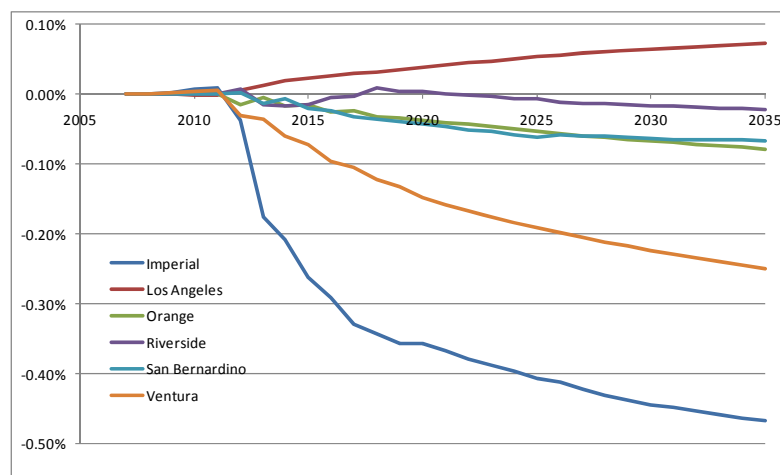
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## Scenario: TOD1

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### ■ Household by County (Difference from Baseline, %)



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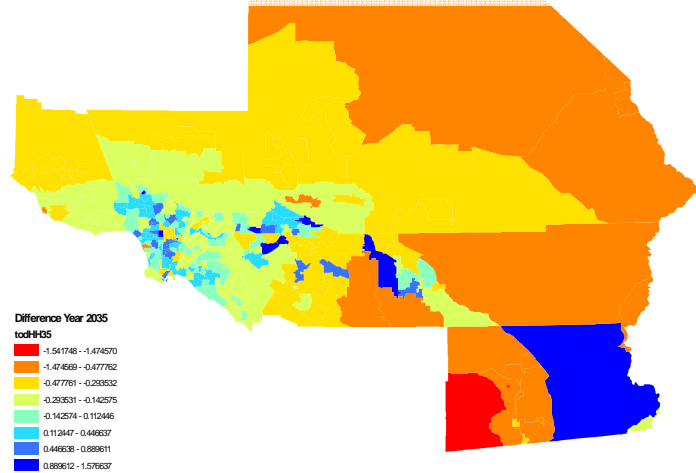
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## Scenario: TOD1

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### ■ Difference of Household from Baseline



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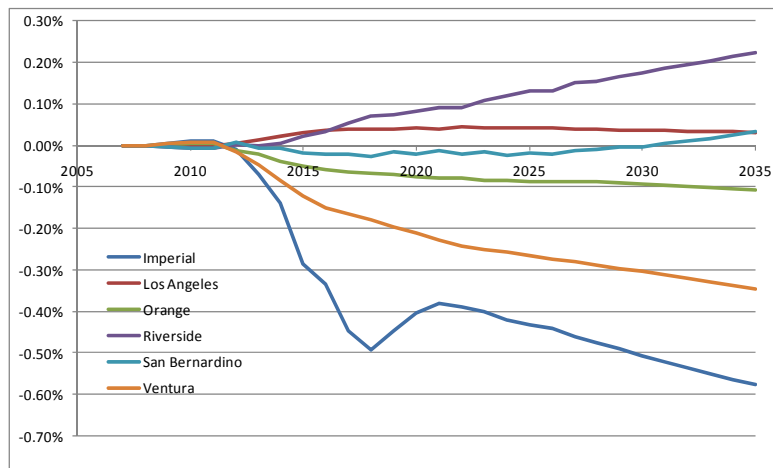
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## Scenario: TOD1

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### ■ Job by County (Difference from Baseline, %)



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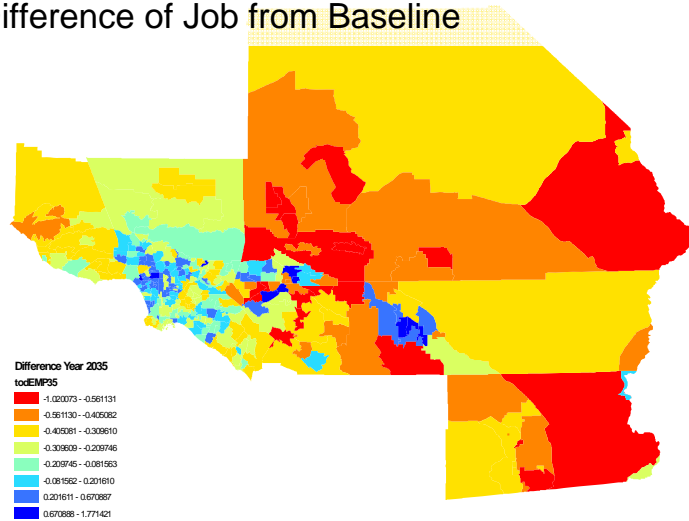
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## Scenario: TOD1

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### ■ Difference of Job from Baseline



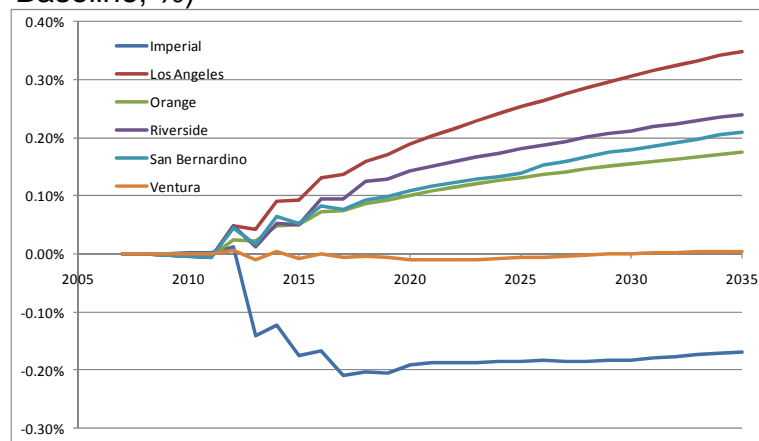
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## Scenario: TOD1

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### ■ Residential space increment (Difference from Baseline, %)



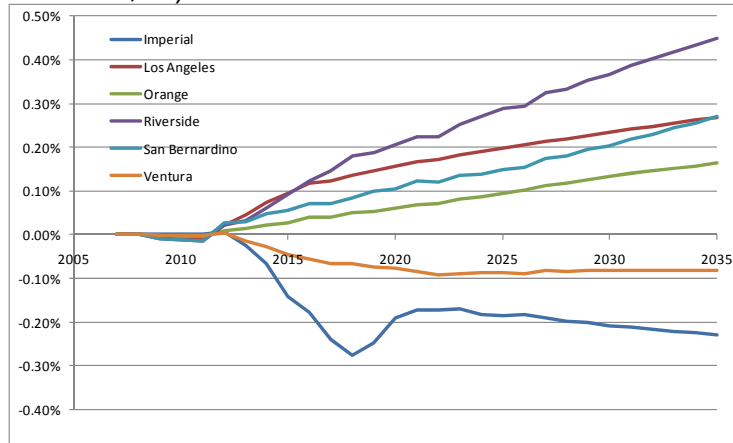
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## Scenario: TOD1

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- Non-Residential space increment (Difference from Baseline, %)



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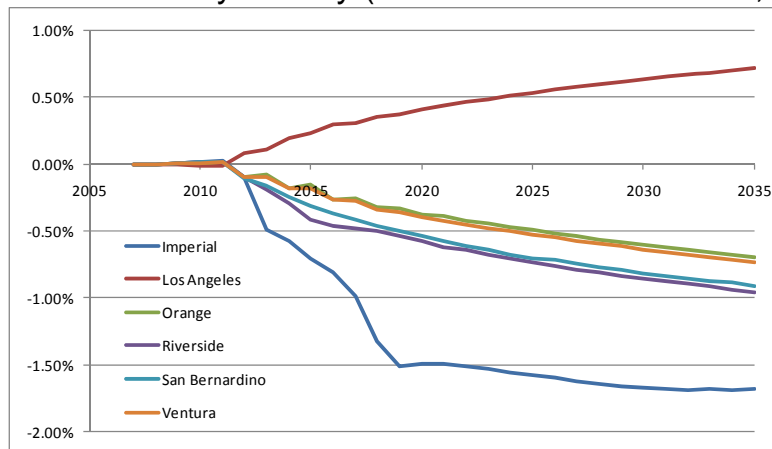
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## Scenario: TOD2 (20X in LA)

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- Household by County (Difference from Baseline, %)



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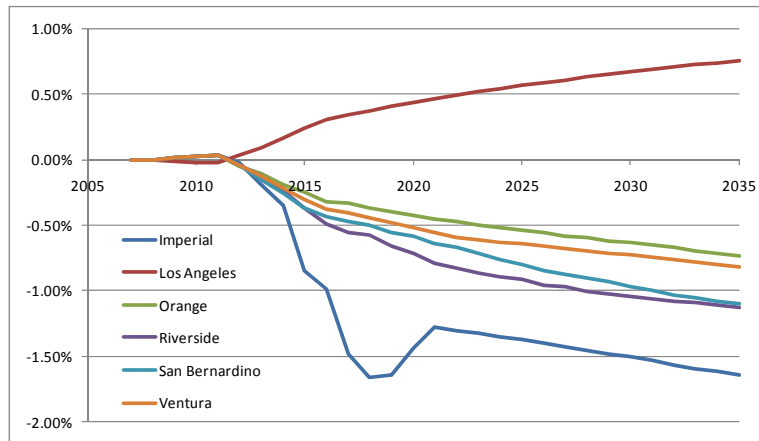
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## Scenario: TOD2 (20X in LA)

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### ■ Job by County (Difference from Baseline, %)



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## Scenario: TOD

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- 50% density increase results 3,000 additional households in LA county, 20X causes 30,000 additional households
- Model responses to capacity through general plan
- Market response (development) is less than the zoning input – model starting to show that developers do not necessarily do what you wish they would.

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## Benefit Measures

1/5

- Consumer Surplus” and “Producer Surplus”
- Value of all options and choices in the model
  - Location
  - Technology
  - Exchange Location for each commodity
- Relative measure only
  - Compare to base scenario to understand benefits of different policies



## Benefit Measures

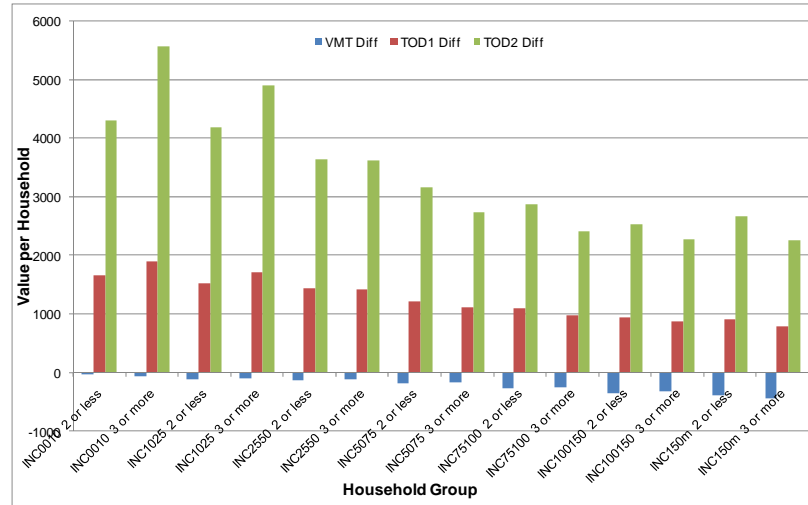
2/5

- Full Integrated Model, combined effect of many items, including:
  - More supply of space leads to lower prices/rent
    - Supply-demand balance
  - Closer locations (less sprawl) leads to lower travel costs
    - Example of lowest level choice in AA
  - Wealthier households are less willing to choose multifamily housing
    - Example of medium level choice in AA
  - Best zones can expand more; more people can live in attractive areas
    - Example of highest level of choice in AA
- Other considerations/enhancements: Owner occupied rent, construction capacity, more technology/location response.



## Benefit Measures - Households

3/5



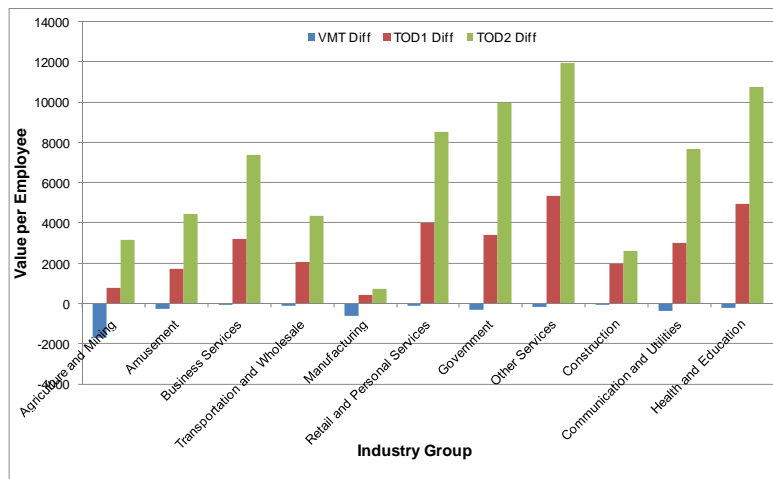
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## Benefit Measures - Industry

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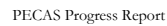


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- Model responds in appropriate directions
- We can see in the magnitude of the model responses which parameters have not yet been adequately calibrated
- Integration of PECAS with the travel model will make the whole modeling program at SCAG more valuable in policy analysis
- Combined land use policies and transportation policies likely necessary to achieve VMT reduction targets

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## Action Items – Short Term

- Adjust selected parameters that came from the statewide model
  - Location choice dispersion factors
  - Technology Option choice dispersion factors
  - Calibrate import and export treatment
- Rerun calibration scripts
  - Buying / Selling dispersion parameters
  - Floor space quantity (match prices with new demand elasticity)
- Deliver By End of March 2011
  - Version 1 model (model data, set up, code)
  - Documents
  - Scenario Test Results
- June 2011 Peer Review



## Action Items – Mid Term

1/2

- By End of 2012
- Review the initial model specifications and parameters from the state-wide model
- Possible design changes based on
  - SCAG priorities
  - SCAG data
  - Ongoing development of the Statewide model
- Integration with regional transportation model
  - 4-step model or Activity-based model
- Selective ongoing calibration
  - Identify parameters, especially the ones from the state-wide model, that had not been updated in phase1
  - Identify most efficient improvements
    - cost vs benefit vs risk



## Action Items – Mid Term

2/2

- Model Validation
  - With multi-year parcel databases, sub-county zonal validation (TAZ and LUZ)
- Scenario Tests
  - Re-run scenarios that have been previously setup, compare results between scenarios.
- Outreach
  - Start planning within SCAG for model use in currently relevant policy analysis
  - Member agency
    - Technical staff, partnerships
  - Other stakeholders



## Q/A

- Question?

